

REMARKS

Claim Rejections

Claims 7-9 and 11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Thomas et al. (US 6,271,514 B1).

Drawings

It is noted that the Examiner has accepted the proposed drawings filed on April 13, 2005.

Claim Amendments

By this Amendment, Applicant has amended claim 7 and added new claim 12 to this application. It is believed that the new and amended claims specifically set forth each element of Applicant's invention in full compliance with 35 U.S.C. § 112, and define subject matter that is patentably distinguishable over the cited prior art.

The primary object of the present invention is to provide a laser scanning unit (2) as shown in Fig. 2, 2A, 2B, 2C, which is improved from the conventional laser scanning unit (1) as shown in Fig. 1, 1A, 1B. The laser beams emitted from a semiconductor laser (20) pass the collimator to form parallel beams, which are directly projected onto a MEMS oscillatory mirror (22), then the MEMS oscillatory mirror (22) oscillates in a harmonic motion at a certain oscillating amplitude, so as to control a direction in which incident laser beams reflected, and cause the laser beams to reflect onto the f-sin Θ lens (23) located at the one side of the MEMS oscillatory mirror (22). The laser beams incident on the f-sin Θ lens (23) are focused to form a circular light spot that is then projected onto a photoreceptor drum (17, the same as shown in Fig. 1, 1A, 1B.) to achieve a scanning linearity required by laser scanning unit.

The laser scanning unit (2) of the present invention includes only a semiconductor laser (20), a collimator (21), a micro electronic mechanic system (MEMS) oscillatory mirror (22) located directly between the collimator (21) and the f-sin Θ lens (23), and the f-sin Θ lens (23) is located in a fixed position, wherein the

laser beams incident on the $f\text{-sin}\Theta$ lens (23) via the MEMS oscillatory mirror (22) are focused to form a circular light spot that is then projected onto a photoreceptor drum (17, the same as shown in Fig. 1, 1A, 1B.) to achieve a scanning linearity required by laser scanning unit.

The cited reference to Thomas et al. teaches a scanning element (240) directing multiple scan beams (249) onto post-scan optics (250). Scanning element (240) is preferably a rotating polygon mirror but alternatively an oscillating mirror or a rotating holographic element could be employed. The post-scan optics (250) focuses scan beams (249) as scan beams (249) sweep along scan line on a surface of a workpiece. Post-scan optics (250) includes a scan lens (252) and a reduction lens (258). In an exemplary embodiment of system (200), scan lens (252) is an $f\text{-}\Theta$ lens because such lens are known to provide a uniform scanning rates. Scan lens (252) can alternatively be another type of lens such as a $f\text{-sin}\Theta$ lens, which reduces scan line bow for extended scan brushes but causes the scan rate to be non-uniform. Reduction lens (258) reduces the scan line and resulting image size as required for the image to be formed on the workpiece. For the exemplary embodiment, the workpiece is a mask, a reticle, an unprocessed wafer, or a partially processed wafer that is coated a layer of photoresist (column 4, lines 18-35, and Fig. 2).

The distinguishing features between the present invention and Thomas et al. are listed below:

1. The structure of the present invention (laser scanning unit 2) only comprises a semiconductor laser (20), a collimator (21), a micro electronic mechanic system (MEMS) oscillatory mirror (22) located between the collimator (21) and the $f\text{-sin}\Theta$ lens (23), and a $f\text{-sin}\Theta$ lens (23) located in a fixed position. Compare the Fig. 2 of the present invention with Fig. 2 of Thomas et al.
2. The primary object and function of the present invention is different from Thomas et al., especially the laser beams incident on the $f\text{-sin}\Theta$ lens (23) via the MEMS oscillatory mirror (22) are focused to form a circular light spot that is then projected onto a photoreceptor drum (17, the same as shown in Fig. 1, 1A, 1B.) to achieve a scanning linearity

required by laser scanning unit (2) of the invention. Although Thomas et al. discloses that scanning element (240) is preferably a rotating polygon mirror but alternatively an "oscillating mirror" or a rotating holographic element could be employed (column 4 , lines 18-22, and Fig. 2), Thomas et al. doesn't disclose or teach that the "oscillating mirror 240" is a "MEMS oscillatory mirror 22" being the same type as disclosed in the present invention (as shown in Fig. 2, 2C).

3. The f-sin Θ lens (23) disclosed in the present invention is different from the f-sin Θ lens (240) as disclosed in Thomas et al, because the shape and the structure of the f-sin Θ lens (23) as shown in Fig. 2 of the present invention is a long and narrow body which is different from the f-sin Θ lens (240) as shown in Thomas Fig. 2. In the present invention, the laser beams incident on the f-sin Θ lens (23) via the MEMS oscillatory mirror (22) are focused to form a circular light spot that is then projected onto a photoreceptor drum (17, the same as shown in Fig. 1, 1A, 1B.) to achieve a scanning linearity required by laser scanning unit (2). Also, the present invention doesn't include a reduction lens (258) as shown in Thomas et al.
4. Thomas et al. discloses post- scan optics (250) including a scan lens (252) and a reduction lens (258). In an exemplary embodiment of system (200), scan lens (252) is an f- Θ lens because such lens are known to provide a uniform scanning rates. Scan lens (252) can alternatively be another type of lens such as a "f-sin Θ lens", which reduces scan line bow for extended scan brushes but causes the scan rate to be "non-uniform" (column 4 , lines 27-38, and Fig. 2). Therefore the f-sin Θ lens (23) of the present invention is used to cooperate the MEMS oscillatory mirror (22) to achieve a scanning linearity required by laser scanning unit 2, but Thomas et al disclose and teach that the "f-sin Θ lens 252" would cause the scan rate to be "non-uniform".
5. The present invention discloses the f-sin Θ lens (23) being used to cooperate with the MEMS oscillatory mirror (22) to achieve a scanning

linearity required by laser scanning unit (2,) but Thomas et al. doesn't disclose or teach the relation between "oscillating mirror 240" and "f-sin θ lens 252", especially since the "f-sin θ lens 252" of Thomas et al. causes the scan rate to be "non-uniform".

Thomas et al. do not teach the collimator directly projecting the parallel beams onto the micro electronic mechanical system (MEMS) oscillatory mirror; the micro electronic mechanical system (MEMS) oscillatory mirror is located adjacent to the collimator; nor do Thomas et al. teach the Fsin θ lens has an elongated shape with elongated sides, the parallel beams passing through an opposing pair of the elongated sides of the Fsin θ lens.

It is submitted that Thomas et al. do not disclose, or suggest any modification of the specifically disclosed structures that would lead one having ordinary skill in the art to arrive at Applicant's claimed structure. Thus, it is not believed that Thomas et al. render obvious any of Applicant's new and amended claims under 35 U.S.C. § 103.

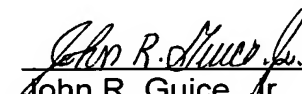
Summary

In view of the foregoing amendments and remarks, Applicant submits that this application is now in condition for allowance and such action is respectfully requested. Should any points remain in issue, which the Examiner feels could best be resolved by either a personal or a telephone interview, it is urged that Applicant's local attorney be contacted at the exchange listed below.

Respectfully submitted,

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By:



John R. Guice, Jr.
Reg. No. 39,699

TROXELL LAW OFFICE PLLC
5205 Leesburg Pike, Suite 1404
Falls Church, Virginia 22041
Telephone: 703 575-2711
Telefax: 703 575-2707

CUSTOMER NUMBER: 40144